



NO. 17, LAKE SQUARE OFFICE PARK  
SUITE 20, MONTREAL CIRCLE  
TUCKER, GEORGIA 30084  
(404) 938-7710

1 1 0001 16612  
**CONFIDENTIAL**

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February 25, 1983  
C-586-2-3-40

Mr. R. D. Stonebraker, Deputy Chief  
Emergency & Remedial Response Branch  
Air & Waste Management Division  
Environmental Protection Agency  
345 Courtland Street, N.E.  
Atlanta, Georgia 30365

Dear Mr. Stonebraker:

This letter provides our conclusions and recommendations on the Saad sampling study in Nashville, Tennessee. To support our ideas a brief geological summary is first provided.

The Saad Site and Croft farm are both underlain by rocks of the Ordovician Age. The two formations underlying the site are the Bigby Cannon Limestone and the Hermitage Formation, respectively. Both formations range in thickness from 60 to 100 feet. The Bigby Cannon limestone is dark gray to brownish-gray in color, thin to medium bedded with pronounced conchoidal fracturing present. Fracture zones in the formation tend to form solution cavities due to groundwater movement. Because of the extensive fracturing, a network of groundwater pathways may develop in the formation making ground-water flow possible in numerous directions. Sinkholes have developed in the vicinity of the site creating recharge zones for groundwater. The Croft spring is a discharge point for groundwater under the site and is believed to be at the contact of the Bigby Cannon Limestone and Hermitage Formation. The stream formed by the Croft spring flows into Seven Mile Creek which joins Mill Creek in route to the Cumberland River. Approximately 1/2 mile downstream of the Cumberland River and Mill Creek confluence is the river intake for the city of Nashville's drinking water purification system. The total distance from the Croft spring to the river intake is approximately 9 1/2 nautical miles.

The effects of poor waste management in such geological localities is demonstrated by the impact of Saad's operation in Smyrna, Tennessee. In less than one year following the surface dumping of liquid organics, wells close to the disposal in several directions were contaminated. Wells along the apparent major groundwater flow path at distances over 1 mile away also were polluted. Thus the potential for rapid contaminant movement in groundwater is high.

The Saad sink hole, as indicated by the boring logs of the monitoring well, extends downward to the top of the Bigby-Cannon some 16 feet below the land surface. The monitoring well was installed through the waste zone and into a water bearing

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C-586-2-3-40

Mr. R. D. Stonbraker, Deputy Chief  
Environmental Protection Agency  
February 25, 1983-Page Two

fracture near the contact of the two limestone formations. A geological cross-section of the subsurface below the Saad Site is detailed in the attached sketch. It is noteworthy that 6 of the 7 most concentrated purgeable organics found in the monitoring well water were also found in the shallow soil sample collected in the pit. These six common contaminants were found in the parts per million range in both the soil and water. This level of groundwater contamination is disturbingly high, particularly in a limestone karst situation where rapid contaminant migration is possible without soil attenuation. Since these levels of groundwater contaminants were only found below the pit it is suggestive that the Saad Site is a major pollution source.

Ten organic compounds found in the groundwater below the Saad pit were also groundwater contaminants below L & N, but at much lower concentrations (an average of 120 fold less). This finding suggests that the Saad waste is contributing to groundwater pollution below the Radnor Yards.

Only one well was installed in the L & N property which covers 137 acres. Therefore this study is not a thorough characterization of the groundwater below the railroad yard. This deficiency may account for the absence of diesel fuel in L & N groundwater which is surprising given the railroads past operational history.

Five organic compounds found in L & N and Saad groundwater were also groundwater contaminants on the Croft farm. Three organic compounds were found in the first Croft spring water samples that were found in the Saad groundwater, one of these was also found in L & N groundwater. No organics were found in the spring water from the second sampling. This variation in contaminants makes it impossible to accurately assess the spring pollution or to compare spring water analysis data with contamination at L & N and Saad.

The vast preponderance of the organic compounds detected in the groundwater samples are chlorinated hydrocarbons which are of significant public health concern. The ingestion of many of the chlorinated hydrocarbons found at the site can result in the depression of the central nervous system, gastrointestinal upset, and liver and kidney degeneration. A more insidious hazard is presented by the carcinogenic potential of a few of these compounds. In 1978 twenty-one chemicals found in this country's drinking water supplies were characterized as having carcinogenic activity; four of these compounds are found in the water at the Saad Site (vinyl chloride, chloroform, 1-2 dichloroethane and benzene are suspected of causing adenocarcinoma and leukemia respectively). The concentrations of these four compounds, particularly in the ground water below the Saad pit, are high for

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C-586-2-3-40

Mr. R. D. Stonebraker, Deputy Chief  
Environmental Protection Agency  
February 15, 1983-Page Three

water samples and unacceptable particularly in view of the belief that carcinogens can act in a nonthreshold fashion.

Particularly noteworthy is the absence of diesel fuel in the spring which was thought to be a major contaminant because of reported diesel fuel odors and the operational practices at L & N. A more thorough sampling would perhaps allow for evaluation of contaminant variation and provide insight regarding pollution sources.

Based upon our experiences to date FIT makes the following recommendations:

- o FIT recommends the removal of contamination from the Saad sink area. Sampling strongly indicates this area is a groundwater pollution source providing high concentrations of toxic organics. The complete removal of this contamination may be difficult because a building has been erected over the filled sink area. A thorough engineering feasibility analysis is required.
- o Due to the apparent seasonal fluctuations in the depths of the groundwater table, a long term sampling schedule that includes the monitoring wells and Croft farm springs is recommended. Past sampling has shown that samples collected at different times contain different contaminants. A long-term program should better identify the types and concentrations of contaminants and support a more accurate hazard assessment.
- o The feasibility of the installation of additional monitoring wells should be considered. Additional wells may more accurately locate the flow paths of contamination, characterize contaminants and provide needed background data. Also, the direction of groundwater flow patterns in the karst area could be more accurately determined. However in the karst geology, tracking of the plumes may be impractical and the feasibility study should recognize this risk.
- o The FIT sampling study only included one well on the L & N property, consequently this suspected pollution source is poorly characterized. FIT recommends that EPA consider the value of a more complete monitoring well program for the Radnor Yards. FIT could assist in this evaluation by providing a design and cost estimates.

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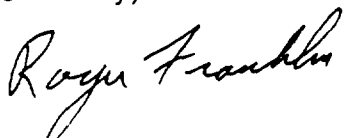
C-586-2-3-40

Mr. R. D. Stonebraker, Deputy Chief  
Environmental Protection Agency  
February 15, 1983-Page Four

- o The two residential wells were contaminated with two organic compounds also found in the groundwater below the Saad pit. One of these compounds was found in one of the Croft farm wells. FIT recommends a thorough sampling of all local private wells to further evaluate water quality.

I hope you find the above comments useful in further management of the site's pollution problems. If you need further assistance from FIT please let me know.

Sincerely,

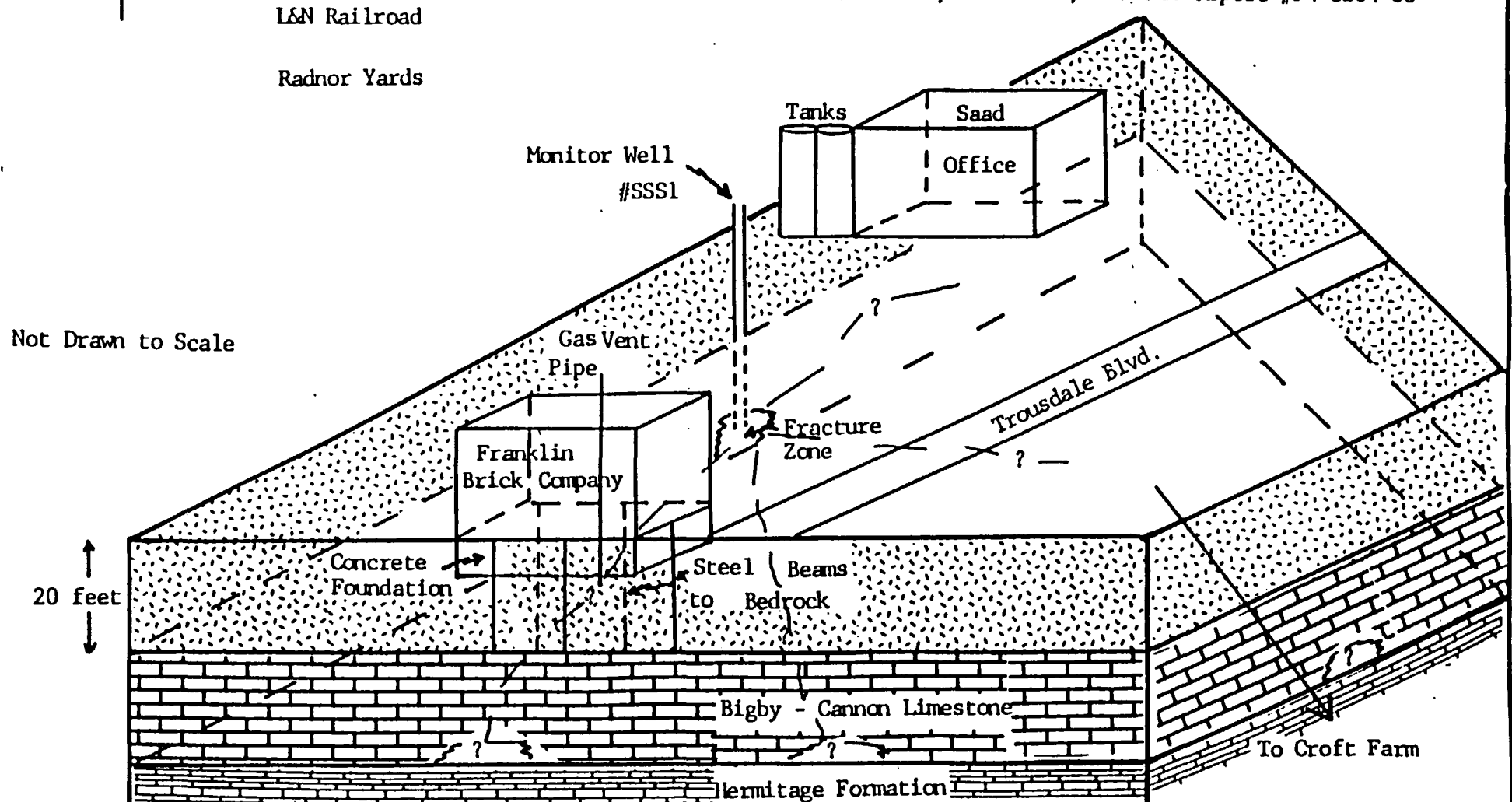


R. Roger Franklin  
Environmental Scientist

RF/ms

Based on existing data concentrated waste exists  
in an area of 0.6 acres and is approximately 20 feet deep.  
Waste Volume is estimated to be 18,650 cubic yards.

Reference: Figure 3.1 & 3.2 Installation of Monitor Wells,  
Saad Site, Nashville, TN. FIT Report #F4-8204-06



Legend

Waste Material



Generalized Sketch  
of Subsurface  
Beneath Saad Site

1 1 0005

SAAD CASE CHRONOLOGY OF VIOLATIONS, ETC.

*Barry Salkin - water quality control (WQC)*

10-13-79 BWS memo to Lee Treckenridge - Documentation of lack of compliance, request for enforcement action, including civil penalty

4-7-80 BWS, GWS inspection of Trousdale - measured contents of tanks

7-23-80 BWS memo to file - inspection - barrels still not removed from Trousdale

9-25-80 BWS memo to Terry Cochran - update on case

12-3-80 TKC memo to John Fitzgerald - request for enforcement

12-17-80 Gary Simpson memo to TKC - says that state has pursued legal recourse to a reasonable extent, not aware of any proven violations of Court Order

1-6-81 Bill Barrick letter to Gary Blackburn - remove barrels from Trousdale within 30 days

1-28-81 Citizen's suit tried in Murfreesboro - Saad found liable and <sup>1/</sup>assessed damages

2-6-81 BWS memo to TKC & WMB - continued violations of Court Order

2-18-81 BWS memo to TKC & WMB - continued violations of Court Order

4-13-81 TKC memo to WMB - request for enforcement

7-16-81 BWS memo to file - continued violations

1-28-82 Ray Osejo memo to file - citizen complaint

2-23-82 BWS notes meeting between SWM, WQC, and Saad

2-27-82 Saad's application to have barrels disposed

3-3-82 BWS memo to file - meeting with Water Resources, regarding Museum (Croft) property

3-4-82 Ray Osejo memo to file - notes from 2-23-82 meeting with Saad

3-11-82 BWS memo to file - inspection of Trousdale on 3-3-82 with Elmo Lunn and Mike Bruner - continued violations

3-12-82 BWS memo to file - inspection of Trousdale on 3-11-82 with Tom Devine; EPA - continued violations

3-18-82 Ray Osejo samples from Trousdale  
 3-23-82 BWS memo to file - meeting with EPA  
 3-31-82 Letter to Saad accepting proposed barrel shipment  
 4-13-82 BWS memo to file - EPA/E&E visit to all Saad sites  
 4-23-82 BWS memo to file - meeting with CDC  
 5-7-82 Meeting with EPA, etc.  
 5-11-82 BWS memo to WMB - request for legal opinion  
 5-19-82 Citizen's 340 (a) complaint received by Commissioner  
 6-2-82 BWS notes - meeting with RDC on 340 (a) complaint  
 6-7-82 Complaint responses  
 6-10-82 Meeting with Dr. Bruner - Don Rima named lead person on case  
 6-18-82 Don Rima memo to DEL, TKC case update  
 7-29-82 SWM 340 (a) report

3-13

Sept 1982 Visit to Craft Spring by Harold Mulican, TOPIT consultant,  
 I identified presence of iron fixing bacteria in spring  
 water

## Croft Spring Chronology

- 19, 1968. Complaint received of contamination of Croft Spring. Investigation indicates presence of diesel fuel - L & N related
- 7/2/1970 Saad opened Trousdale operation  
(See RLS memo 9-25-78)
- Feb. 14, 1978 Memo from Chattanooga Basin Office to Nashville Basin Office re: Montague, Saad, and Trousdale sink
- March 1978 Visit to Trousdale site by RLS - found discharge pond containing waste solvent, etc.
- Sept 6, 1978 Follow up on clean-up of Trousdale site (memo from RLS) and discovery of Rutherford County property being used as a dumping ground
- March 2 1979 Formal visit to Rutherford County site and "shut down" order issued to Saad
- March 7, 1979 Commissioner orders suit against Saad
- April 18, 1979 Discovery of Hawkins dump containing Saad barrels
- Aug. 20, 1979 Inspection of Trousdale site with backhoe - discovery of contamination
- Nov 13 1979 Discovery of Saad dumping on Bell Co. site



3-18-82 Ray Osejo samples from Trousdale  
3-23-82 BWS memo to file - meeting with EPA  
3-31-82 Letter to Saad accepting proposed barrel shipment  
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7-29-82 SWM 340 (a) report

3-13

Sept 1982 Visit to Croft Spring by Harolda Mulican, TOPIT Chemist,  
I identified presence of iron fixing bacteria in Spring  
water

Chemicals Identified at the Croft Spring Site, Nashville, Tennessee

1,1,1-Dichloroethylene (probably 1,1-Dichloroethylene): Liver damage; probably some renal damage.

Chloroform: Probable carcinogen; liver and kidney damage, nervous system effects, heart effects, skin problems in that it can de-fat the skin and allow penetration to increase rapidly. Also see carbon tetrachloride, below.

Carbon Tetrachloride: Probable carcinogen; liver and kidney damage; nervous system effects, gastrointestinal effects; effects can be increased significantly when combined with alcohol. Can also interact with chloroform to increase liver damage.

1,1,2-Trichloroethane: Suspect carcinogen; potent narcotic and nervous system effects; probable liver and kidney effects.

Tetrachloroethylene: Effects on nervous system, heart, respiratory system and liver. Possible carcinogenic and reproductive effects.

Chlorobenzene: Central nervous system and skin effects.

Dimethyl Benzene(Xylene): Irritation of mucous membranes, skin and lung effects, nervous system symptoms.

Ethyl Benzene (Styrene): Irritation to mucous membranes and skin effects; nervous system effects. Possible reproductive effects and suspect carcinogen.

Trimethyl Benzene: See Xylene

1,2-Dichloroethylene: Irritation and central nervous system effects.

Methyl Benzene (Toluene): Irritation, skin and central nervous system effects.

Toluene: See Above

1,2-Dichloroethane: irritation and eye effects. Lung, liver, and kidney damage can occur. Possible carcinogen.

Trichloroethane: Irritation and possible central nervous system effects. Heart effects and possible mutagenic activity. (There are several trichloroethanes- the exact one not specified)



1 1 0011

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
EDISON, NEW JERSEY 08837

September 18, 1987

MEMORANDUM

SUBJECT: SAAD Waste Oil Geotechnical Investigation Draft Report

FROM: George R. Prince, Environmental Scientist  
Environmental Impact Section  
Environmental Response Branch

A handwritten signature, likely of George R. Prince, is written over the "FROM:" line.

TO: Greg Powell, OSC  
EPA, Region IV

I have attached a copy of a draft report from our EERU contractor covering the drilling program we conducted at the SAAD waste oil site in Nashville, TN. This report will probably remain in draft form as our current contract has expired.

We garnered a significant amount of information from our investigations at the SAAD site. Most of this information is included in this report, but may further require some explanation. We should get together at your convenience to discuss our past efforts and evaluate future needs for removal actions at this site.

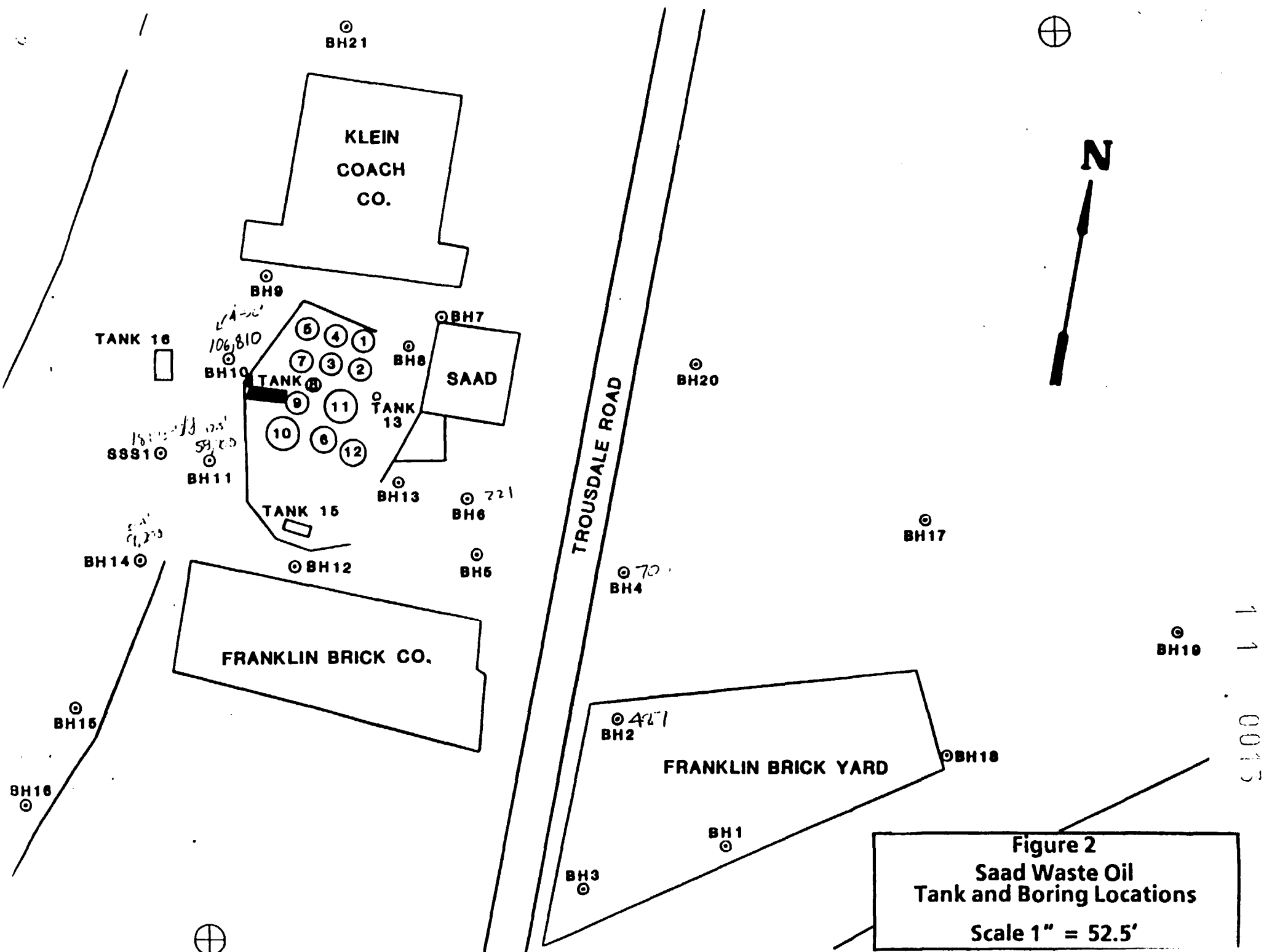
Call me if you have any questions at FTS 340-6649.

Attachment

call on 3/29/88

3rd week of April - maybe  
AKL





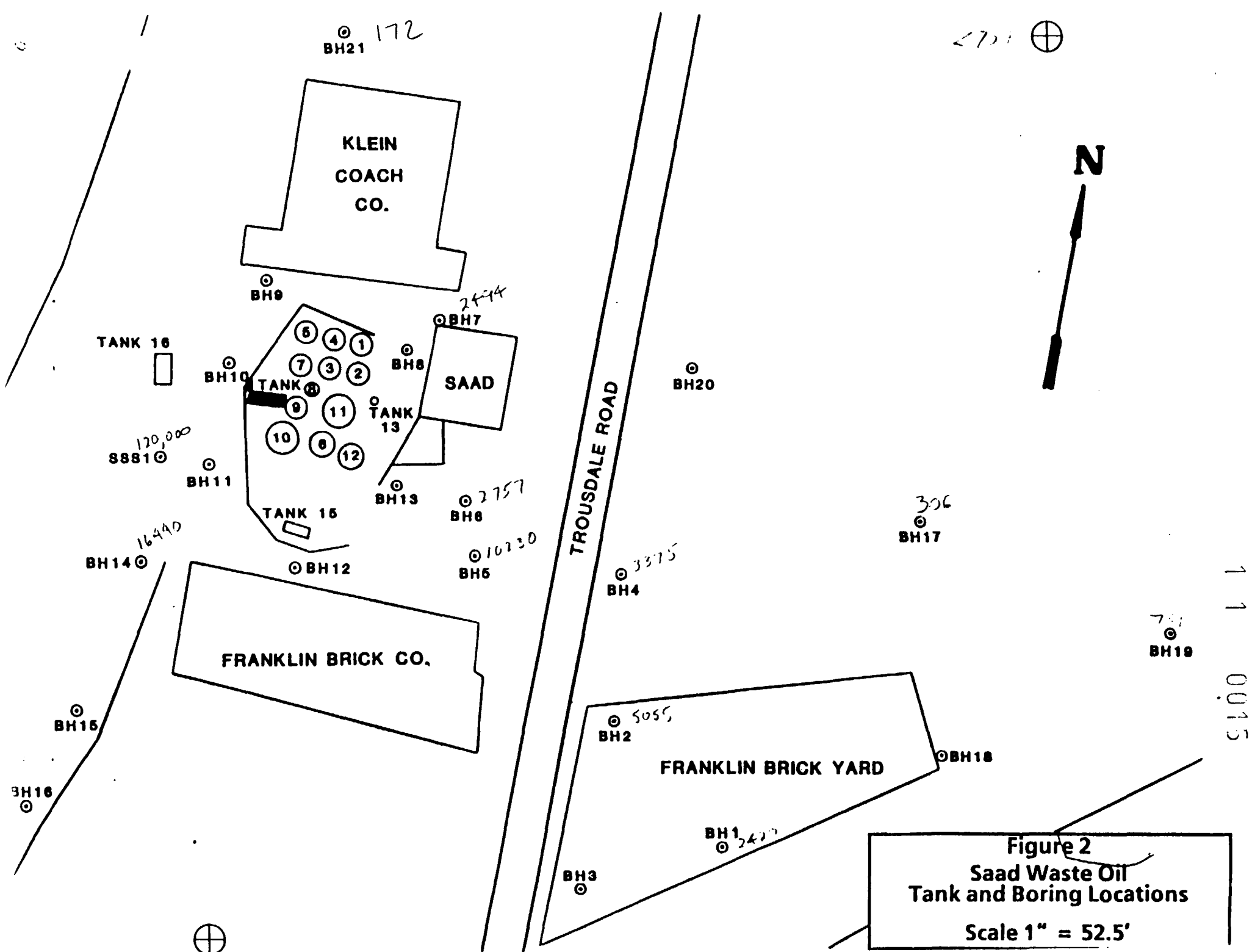
JLE 7  
VOLATILE ORGANICS AND PESTICIDES/PCB'S IN WATER  
Concentrations Reported In ug/L

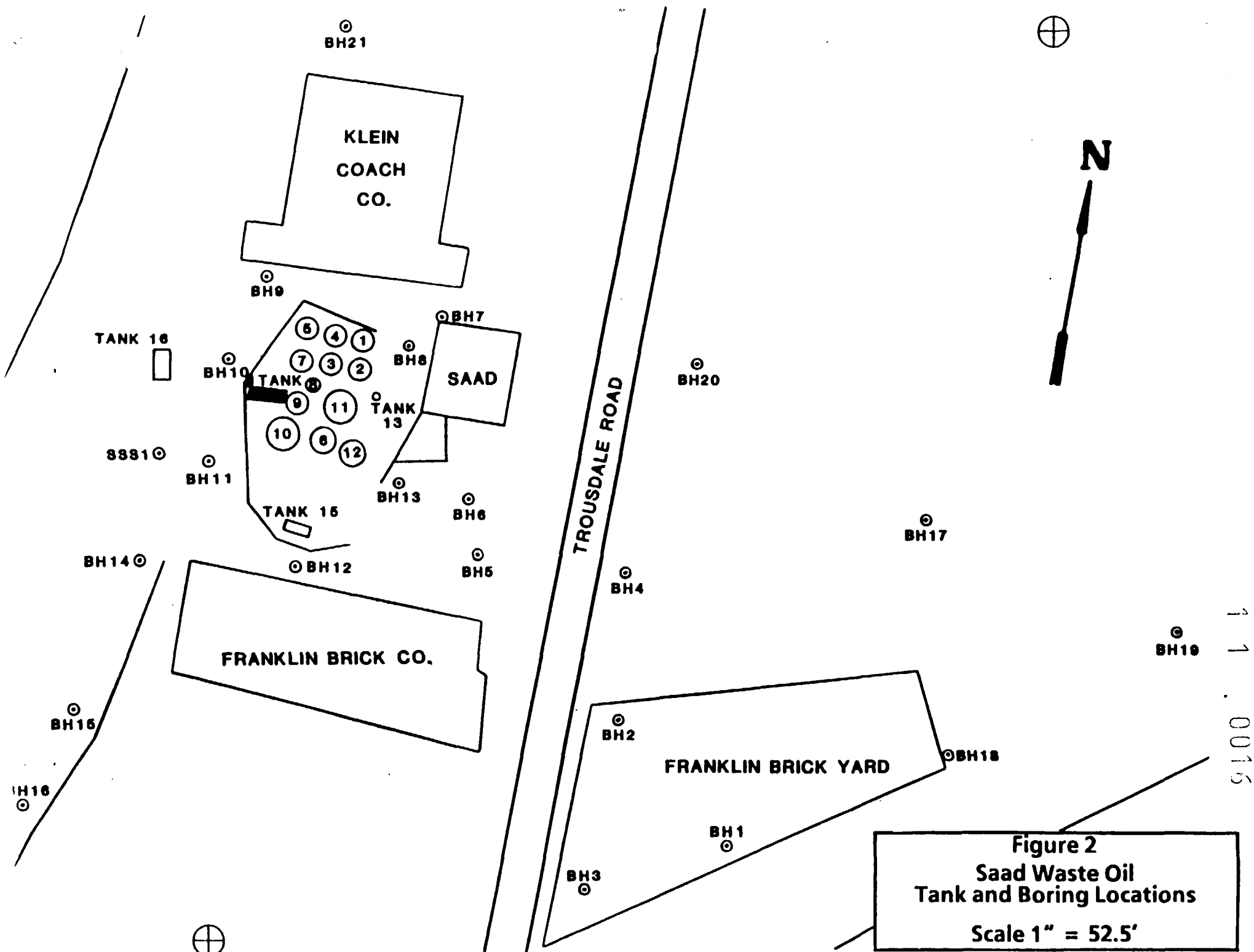
Parameter	Borehole No./Date									
	B-1 3/23/87	B-2 3/23/87	B-4 3/23/87	B-5 3/23/87	B-6 3/23/87	B-7 3/26/87	B-14 3/26/87	B-17 3/23/87	B-19 3/23/87	B-21 3/25/87
Lab Sample No.	5710	5709	5707	5705	5706	5715	5714	5708	5711	5713
Methylene Chloride				200*		53*	2500			1*
Trans-1,2-Dichloroethane	63		420	1200	1900	1800	4100	270	560	14
Chloroethane										13
Toluene	88	4000	1100	7500	360	210	4100			
Total xylenes	1900	880	1500	1100*	150*		310			9
Acetone										68
Chloroform										
Ethyl benzene	220	120*	180				110*			
2 Butanone										9*
4 Methyl-2-pentanone							210*			
Benzene	7*	55*								
1,1 Dichloroethane	78		55	120*	67*	81*	110*	14	39*	33
1,1,1-Trichloroethane										8
Trichloroethene							5000			
Vinyl chloride	64		120		280	350		22	140	18
Carbon disulfide				110*						
Pesticides/PCB's	ND	ND		ND	ND	ND	ND	ND	ND	ND
4,4 - DDT			.56							

ND - None Detected

\*Denotes a value below the limit of quantification that is considered approximate

11014







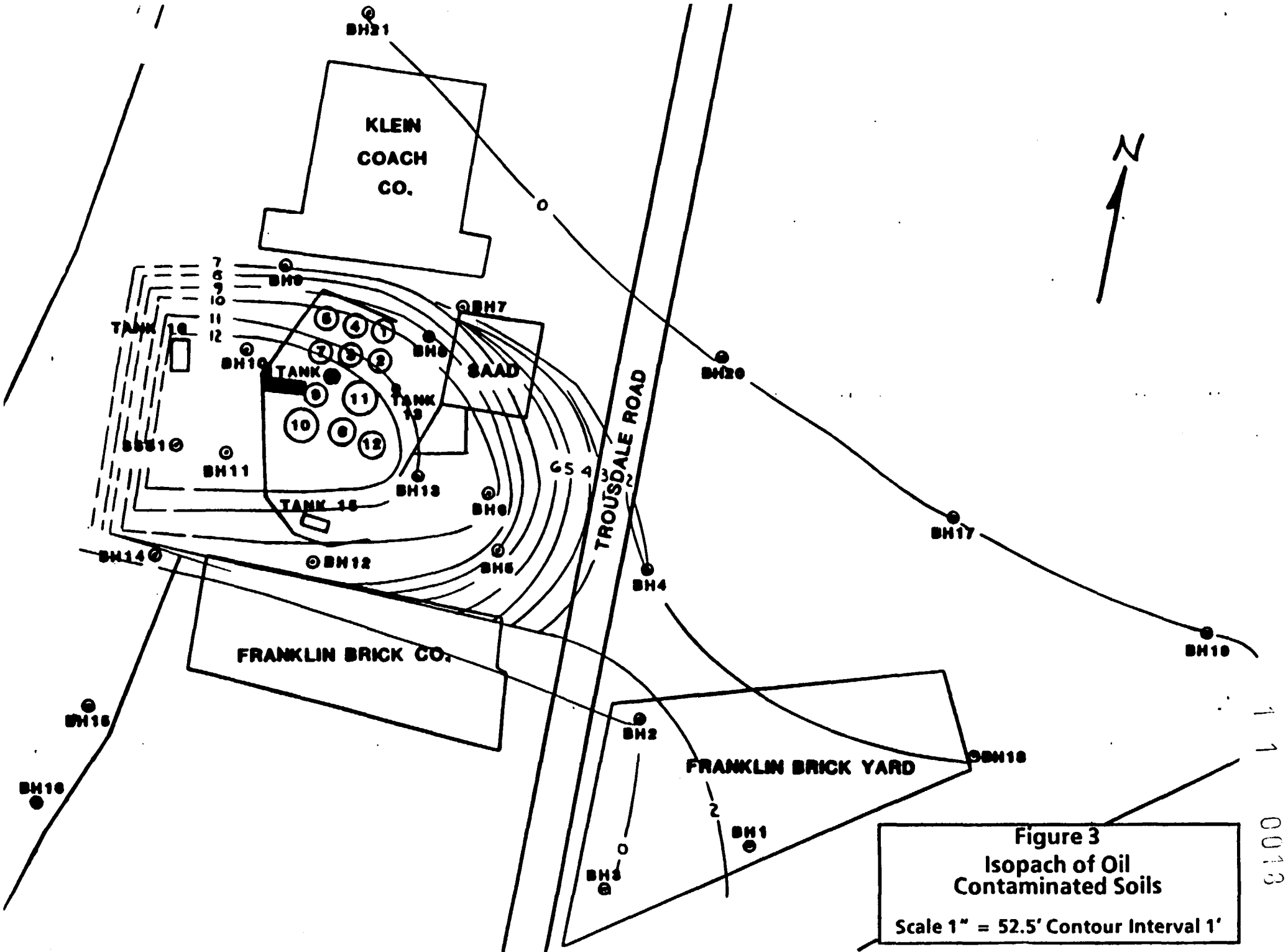
**T E 8**  
**OFF-SITE GROUNDWATER**

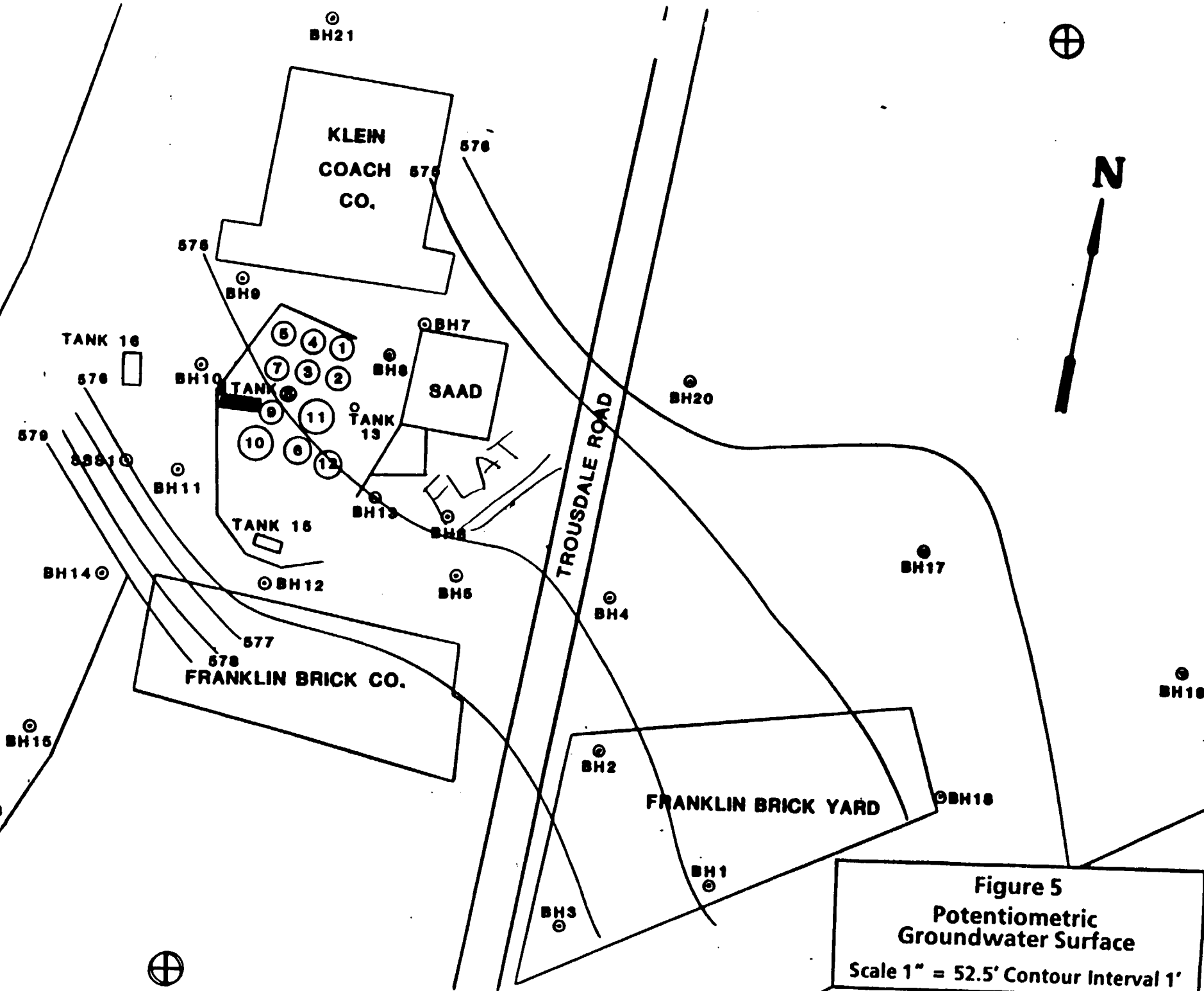
Parameter	Sample									
	Croft Spring	Croft Spring	Croft Spring	Saad Monitoring Well	Saad Monitoring Well 9/87	Well #1 9/87	Well #2	Well #2 9/87	Well #3	Well #3 9/87
Lab Sample No.	SS-S-7-W	SS-CF-SP	7333	SS-SS-MW7	3334	7331	SS-CF-MG2	7332	SS-CF-MW3	7353
Sampling Program			3/87		3/87	3/87		3/87		3/87
1,1 Dichloroethane	2J	ND	ND	1,100	1,700		ND	ND	ND	ND
Chloroform	0.5J			11						
Chlorobenzene	2J									
Vinyl Chloride				6,600	9,800					
Methylene Chloride				19,000	5,500					
1,1 Dichloroethene				690						
Chloroethane				240						
Trans-1,2-Dichloroethane				95,000	52,000					
1,2 Dichloroethane				31						
1,1,1-Trichloroethane				15,000	6,300					
Trichloroethene				69,000	30,000	<5				
Benzene				67						
Tetrachloroethene				49,000	9,600					
Toluene				3,900	4,600					
Chlorobenzene				87						
Ethyl benzene				310	500					

ND - No VOA's detected in analysis

J - Estimated Value

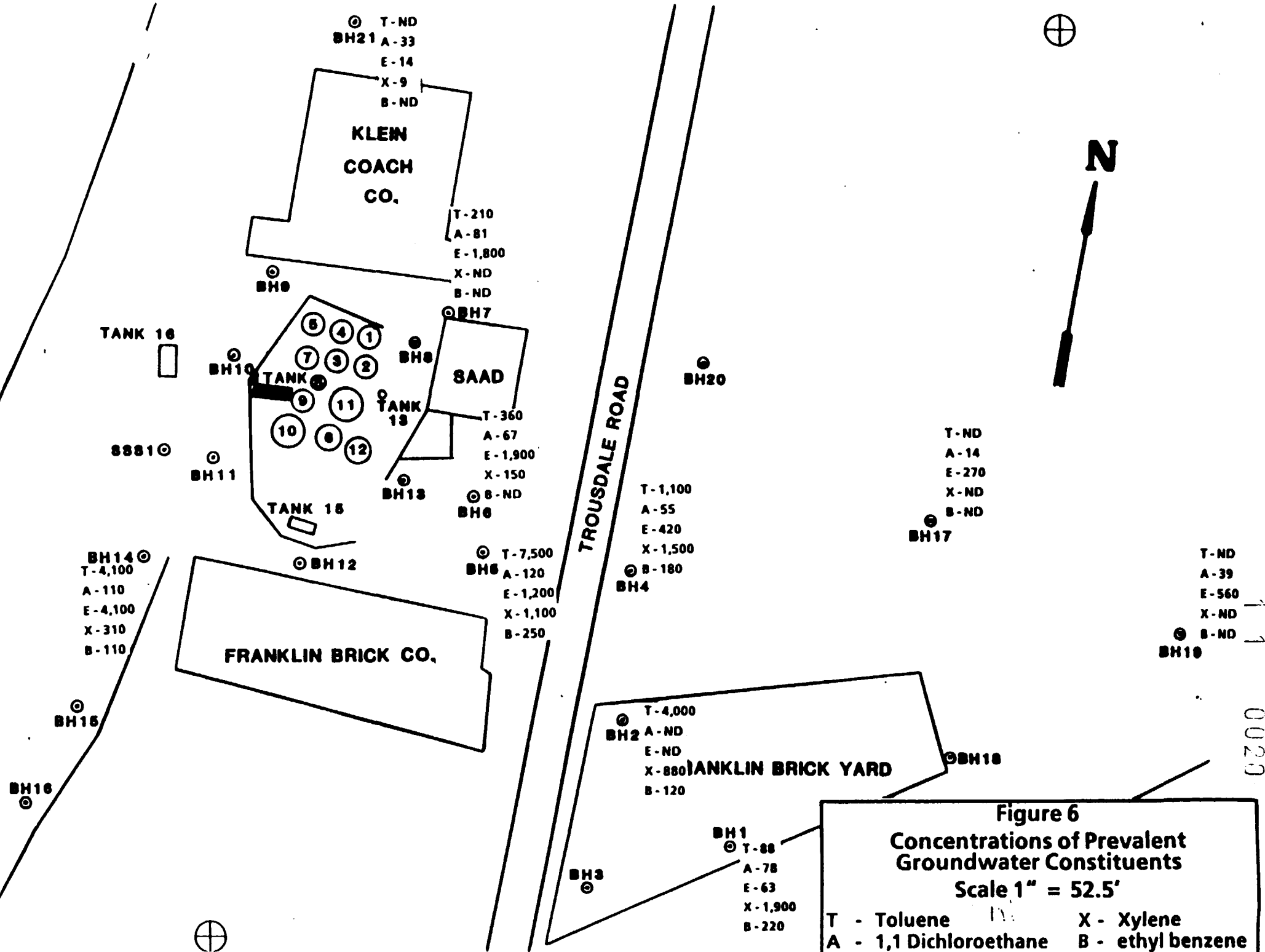
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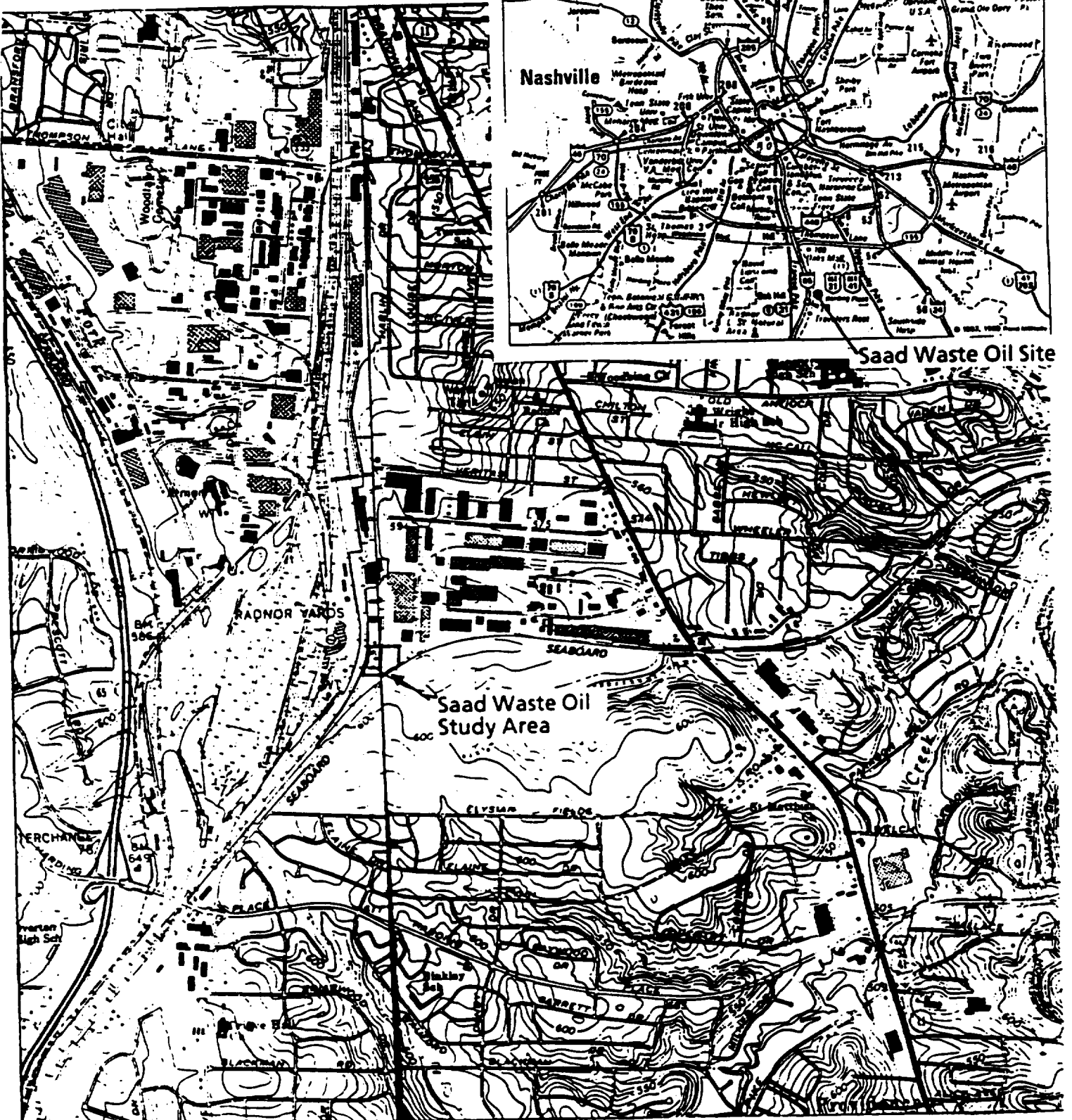




**Figure 5**  
**Potentiometric**  
**Groundwater Surface**  
Scale 1" = 52.5' Contour Interval 1'

1 1 0019





Scale 1:24,000  
Source: U.S.G.S. Oak Hill and Antioch,  
Tenn. topographic Quadrangles  
7 5 Minute Series

Figure 1  
Site Location Map  
Saad Waste Oil Site